ARCH 631. Assignment #1

**Date:** 8/30/16, due 9/8/16

**Problems:**

1. A 24-foot-long steel beam is installed when the temperature is 45°F. How much will it expand if the temperature rises to 75°F? The coefficient of expansion of steel is 0.0000065.
   
   Answer: 0.056 in

2. What is the horizontal thrust at each end of the three-hinged arch shown below?

   Answer: 249.7 k

3. What is the moment about point O of the three forces shown above?
   
   Answer: 10,755 lb-ft

4. Complete text problem 2.4 on page 85.

   The following three forces act through a point: \(P\) at \(\theta_x = 45^\circ\), \(2P\) at \(\theta_x = 180^\circ\), and \(P\) at \(\theta_x = 270^\circ\). Find the equivalent resultant force. [See Figure 2.59(Q4).]
   
   Answer: 1.33\(P\) at 192.8\(^\circ\).

5. Complete text problem 2.7 on page 85.

   Determine the reactions for the structure shown in Figure 2.59(Q7).
   
   Answer: \(R_A = 2667\) lb ↑ and \(R_B = 667\) lb ↓.

6. Complete text problem 2.13 on page 85 for figure Q13c.

   Determine the reactions for the beams shown in Figure 2.59(Q13).
   
   Answer: \(R_{11} = P/2 \rightarrow, R_{12} = P/2 \leftarrow, R_{21} = P \uparrow\).
7. Complete text problem 2.24 on page 86.
   2.24 What is the unit strain present in an aluminum specimen loaded to 10,000 lb/in.$^2$? Assume that $E_a = 11.3 \times 10^6$ lb/in.$^2$
   Answer: 0.000885 in./in.

8. Complete text problem 2.27 on page 86.
   2.27 A steel bar that is 20 mm in diameter is 5 m long and carries a tension force of 20 kN. How much does the bar elongate? Assume that $E_s = 0.204 \times 10^6$ N/mm.$^2$.
   Answer: 1.56 mm.